MAGNETIC SHIELDING DEVICES AND METHODS INVOLVING ACTIVE CANCELLATION OF EXTERNAL MAGNETIC FIELDS AT THE COLUMN OF A CHARGED-PARTICLE-BEAM OPTICAL SYSTEM

Abstract of the Disclosure

Shielding devices and methods are disclosed for canceling the effects of external magnetic fields that otherwise would interfere with proper functioning of a charged-particle-beam (CPB) optical system inside a column. In one embodiment, openings and other disruptions in the continuity of the column are flanked by respective coil sets. Each coil set includes multiple coils that are individually electrically energized. The coils can be inside the column, outside the column, or both inside and outside. The magnitude and direction of the respective composite magnetic fields generated by the coil sets can be changed by adjusting the respective electrical currents flowing through the individual coils. Thus, the magnitude and direction of the composite magnetic field can be manipulated as required to cancel the effects of the interfering magnetic field. In addition, the column can be situated within a shield of an anisotropic magnetic material in which the magnetic flux most readily flows in selected directions. Thus, the flux of an external magnetic field that otherwise would leak into a column is caused to become aligned, in a respective portion of the shield, in the axial direction, thereby reducing its horizontal component.